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THE JOURNAL OF SCIENTIFIC
ILLUMINATION

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OFFICIAL ORGAN OF THE
Illuminating Engineering Society.
(Founded in London 1909.)

This number contains the Address delivered
by **Mr. L. Gaster** (Hon. Secretary) at the
meeting of the Illuminating Engineering
Society on Dec. 15th, entitled: "**Some
events during the Vacation, with
special reference to War Economies
in Lighting.**"

Also an account of the *Visit* paid by the
**Circle of Scientific, Technical, and
Trade Journalists** to the **Universities
of Liverpool and Manchester** on
December 10th - 13th.

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EDITORIAL.

The Visit of the Scientific and Technical Press to Liverpool and Manchester Universities.

In previous issues of the *Illuminating Engineer* accounts have been published of the visits, arranged through the Circle of Scientific Technical and Trade Journalists, to the Imperial College of Science in London, and subsequently to the Universities of Leeds and Sheffield. These visits formed part of a movement for the promotion of closer relations between the Universities of the country and the scientific and technical press.

On pp. 379—386 we now give an account of the visit to the Universities of Liverpool and Manchester, which took place on December 10th—13th. On this occasion, also, the proceedings were full of interest. All were struck by the way in which the work of each University is moulded by the needs of the city it represents. Thus at Leeds and Sheffield, both

great industrial centres, the respective spheres of work have a close relation with the local textile, dyeing and steel industries: at Manchester cotton-spinning and engineering receive special attention, and at Liverpool, as a great shipping and commercial centre, we find in the creation of a School of Commerce, the Department of Geography, and in the famous School of Tropical Medicine yet other illustrations of the intelligent study of local needs. It was interesting to see that at all the Universities visited the importance of a knowledge of foreign languages was recognised, special attention being commonly devoted to Russian and Spanish.

Yet the broader aspects of a University's work, involving the provision of a general liberal education, were not overlooked. Equally interesting is the growing tendency towards co-operation between the Universities and other local educational institutions. Thus at Liverpool, we were given to understand, a conference has been considering the co-ordination of the work of the Engineering Department of the University with the technical schools, and in these deliberations the shipping industry of Liverpool is represented. At Manchester, again, we have in the University and the Municipal School of Technology two complementary institutions which work hand in hand. In his address previous to the inspection of the latter, Principal Garnett explained that, as regards the regular courses of study, the School acted as a part of the University; but at the same time it provides evening and other special facilities for study for those who are occupied with their vocation and are not free to follow a full course of study.

The visit to the two cities was so crowded with interesting items that it is impossible to enter upon a description in this note. Readers will find on pp. 379—386 a full description of the proceedings, although even in this account much has been inevitably omitted. The inspection of this varied work was a revelation to the members of the party, and should have a beneficial broadening influence on the technical journalist. Most of those present were primarily concerned with the treatment of their special subjects at the Universities. For example, those associated with hygiene and medicine were keenly interested in the School of Tropical Medicine at Liverpool, representatives of engineering and electrical papers with the Engineering Departments at both Universities and the Manchester School of Technology, while to others the chemical departments, the cotton-spinning, printing and paper-making plant had a special professional interest.

Yet one could see that the members of the party took an almost equally great interest in the sections of work outside their own immediate sphere, and this was due in no small measure to the admirable and lucid expositions of the Professors in each department. Scientific and technical journalists, as a body, now take an interest in general questions affecting scientific education.

In conclusion it only remains to express our great appreciation of the kind attention shown by Professor Gonner (Deputy Chairman of the Senate of Liverpool University), Sir Henry Miers (Vice-Chancellor of Manchester University), and Mr. Garnett (Principal of the Manchester School of Technology), and the professors of these institutions. Acknowledgment should also be made of the courtesy of the British Westinghouse Electric and Manufacturing Co. and the Ford Motor Co. in inviting the party to visit their interesting works. The visit will long remain a most agreeable memory to all the members of the party.

From the Elementary School to the University.

A most encouraging sign during the past few months, coming as it does in the midst of this period of strain and anxiety, has been the general recognition that the educational system of the country needs overhauling. The future of the country is dependent on the efforts we can make now to secure a properly organised system connecting the elementary schools, the secondary and technical schools, and the Universities.

One of the greatest drawbacks under which the educational system of this country has suffered has been the want of co-ordination—the gaps between the higher education and the lower. The country has never lacked men of great ability and distinction in the higher branches of science and industry. At the other end of the scale we find the workers on the whole industrious, painstaking, of good physique and with a certain inherited aptitude for craftsmanship. But the intermediate link, the army of educated capable men to act as foremen and managers, has been missing.

It is therefore gratifying to notice that in the schemes being presented by various educational bodies, this fact is invariably recognised. It was referred to in the programme of the Educational Reform Council and the Workers' Educational Association, in the "Report on Reforms necessary in National Education," presented in the last number of the Journal of the British Science Guild, and in the scheme now presented by the National Union of Teachers.

In many other respects also, these schemes are in substantial agreement. One of the most important suggestions is that local authorities shall institute a system of compulsory classes for young persons between the ages of 14 and 18. The evils of the present conditions are manifest. A child is educated up to a certain point, and leaves school at the age of 14. He goes into employment, often forgets what he has learned and ceases to take much interest in intellectual pursuits. It is of vital importance to our industrial future that a large proportion of such youths should continue their education during these critical years.

The next step is the provision of adequate opportunities for gifted youths to proceed to the University. This need could usually be met by the liberal provision of bursaries and scholarships, which besides meeting the fees for tuition, should enable the recipient to live in comfort and thus remove the natural but shortsighted anxiety of parents that he should immediately earn money.

Liverpool University, with its magnificent endowment of over £1,000,000, is in a particularly good position to pursue an independent course in education. It was stated that no boy of ability, however poor his parents, is debarred from proceeding by steps from the elementary school to the University. But all cities are not equally fortunate.

In a few cases enterprising employers themselves provide educational facilities during working hours, or make arrangements for workers to attend classes elsewhere. But in many others the matter is ignored, with the result that a boy entering works at an age of 14 may, by the time he reaches 18 years, actually receive higher wages than the boy who has devoted the intervening years to his education.

The response to the measures taken by educational authorities thus depends very greatly on the attitude of employers who, it is to be hoped, will value the services of the better educated youth, and see that he does not suffer but on the contrary receives special encouragement.

Scientific Darkening of the Streets.

On pp. 365—377 we give an account of the proceedings at the last meeting of the Illuminating Engineering Society. The address delivered by the Hon. Secretary dealt mainly with two important topical questions—the exercise of economy in lighting during war time, and the present darkening of the streets.

The authorities have been impressing on the public the need of economies in the use of the national coal supply. On the placards we observe the instructions "Don't waste coal, gas, or electric light," a direction which should meet with general approval and one which the Illuminating Engineering Society has endorsed on general grounds even in times of peace. But it is shown that it is equally important, in order that this recommendation may be effectively carried out, that the public should be educated to appreciate how economies should be judiciously executed. Light is a necessity to the carrying on of modern business and an indiscriminate diminution in the amount of illumination would react prejudicially on industrial operations, leading to increased accidents, spoiled work and diminished output. The right form of economy is to avoid improper use of light and here the Illuminating Engineering Society, whose services as an educational medium are recognised by many Authorities, could be of assistance.

The progressive increase in the number of street-accidents since the outbreak of war was discussed in a recent editorial. But apart from this, the present diminution of lighting, by interfering with traffic during the busy hours, is a direct economic loss. These questions will no doubt receive the attention of the "Safety First" Council for London, on which the Illuminating Engineering Society is to be represented.

At present, it is generally agreed that in many areas there is little scientific method in the darkening arrangements, and the conditions prevailing in various districts are quite different. This is no doubt a consequence of the effort to comply with conflicting claims by different authorities urging respectively the claims of precautions against aircraft, economy, and the convenience of traffic. There is an urgent need for a central authority, acting under expert advice, and in a position to survey the problem of the darkening of the streets as a whole and decide upon the best way of meeting these apparently conflicting requirements.

One of the most striking defects of the present arrangements is the great contrast in light and shade resulting from the present methods of screening. Attention was called to this matter at a meeting of the Society in November, 1914, shortly after the lighting restrictions were first introduced. Now, we understand, some experiments are being made with a view to securing greater uniformity of illumination. In addition the question must arise whether at the present stage experience justifies such an extreme diminution in illumination.

The whole problem is one on which expert assistance is badly needed, and we believe that the Illuminating Engineering Society, representing as it does all the different aspects of lighting, could do useful work if greater advantage were taken of their services by the Authorities concerned.

LEON GASTER.

TRANSACTIONS

OF

The Illuminating Engineering Society.

(Founded in London, 1909.)

*The Illuminating Engineering Society is not, as a body, responsible
for the opinions expressed by individual authors or speakers.*

SOME EVENTS DURING THE VACATION, WITH SPECIAL REFERENCE TO WAR ECONOMIES IN LIGHTING.

(Address delivered at a meeting of the Society held at the House of the Royal Society of Arts,
18, John Street, Adelphi, London, at 5 p.m. on Friday, December 15th.)

A meeting of the Society took place as stated above on Friday, December 15th, at 5 o'clock. In the unavoidable absence of the Chairman of Council (Mr. F. W. Goodenough), Mr. W. C. CLINTON presided.

The minutes of the last meeting having been taken as read, the HON. SECRETARY read out the names of new applicants for membership as follows:—

Chandler, D	..	South Metropolitan Gas Co., Old Kent Road, S.E.
Phillips, T. B.	..	" " " " " " " "
Oxley, W. B.	..	" " " " " " " "
Torry, W. R.	..	" " " " " " " "
Winter, B. F.	..	" " " " " " " "
Walford, H. H.	..	Manager of the heat-resisting glass globe department, Messrs. Chance Bros. and Co., Glass Works, near BIRMINGHAM.

proper of his address Mr. GASTER made a special reference to the great loss which the Society had sustained in the death of its first President, Professor Silvanus P. Thompson, which occurred shortly after the Annual Meeting in May. In this connection Mr. GASTER read a letter from Mr. F. W. GOODENOUGH, who, after explaining that he was unavoidably prevented from being present at the

The CHAIRMAN then called upon Mr. L. Gaster to deliver his address on "Some Events during the Vacation, with special reference to War Economies in Lighting."

Before proceeding to the subject

meeting owing to special war work, added:—

I should like to associate myself as Chairman of the Council, and also in my personal capacity, with the tribute paid in the address which you are giving this evening to the late Professor

Silvanus Thompson. His death is a very grievous loss to the Society, to which he always gave such ready and peculiarly valuable assistance, and to everyone who had the privilege of counting him amongst their friends.

We shall sadly miss his versatile and brilliant personality at the meetings of the Illuminating Engineering Society. It might well be said of him in that connection that he never touched upon any subject without contributing something original to its illumination.

Continuing, Mr. GASTER said that the Society had been honoured by a special message of sympathy from the Electro-technical Section of the Société Impériale Technique de Russie, of Russia, which was as follows:—

Société Impériale
Technique de Russie,
Petrograd.
Panteleimonskaja, 2.
Section Electrotechnique.

To the
Illuminating Engineering
Society,
London.
4/17th November 1916.
No. 860.

GENTLEMEN,

The Electrotechnical Section of the Russian Imperial Technical Society has learned with profound regret of the death of the highly distinguished President of the Illuminating Engineering Society—the eminent Professor Silvanus P. Thompson, who was as well known and admired by Russian electricians as by those of the rest of the world.

On account of the cessation of meetings during the summer time, it is only to-day that the Electrotechnical Section has had the opportunity to express its most sincere sympathy with you, as with the City and Guilds Technical College and with the various British learned societies in the great loss you have sustained by the death of Professor Thompson.

We may add that, on receipt of the sad news, the members of the Electrotechnical Section honoured the memory of the late Professor by standing.

Wishing to your Society a continued and increasing prosperity,

We are, Gentlemen,
Yours very truly,
(Signed) Professor P. OSSADTCHY,
President of the Section.
„ D. MEISEL,
Secretary.

He need not say that this reference to the great qualities of the late Professor Thompson would be very much appreciated by the members of the Society. A tribute to Professor Thompson's great services to science was also paid in the official organ of the Society shortly after his death, and at the service immediately

preceding the funeral the Society was officially represented.

Mr. L. Gaster then proceeded to deliver his address, which will be found on pp. 367—374.

In the subsequent discussion Mr. H. E. BLAIN (Operating Manager of the London General Omnibus Co., Ltd.), Mr. F. W. WILLCOX, Mr. A. CUNNINGTON, Mr. S. R. MULLARD, Mr. M. WYLD (Electrical Engineer to the Hampstead Borough Council), and Mr. J. S. Dow took part.

Mr. L. GASTER briefly replied and a vote of thanks to him for his address terminated the proceedings, the Chairman announcing that at the next meeting, to be held in January, there would be a discussion on “The Lumen as a Basis of Measurement of the Illuminating Power of Lamps.”

LIGHTING CONDITIONS IN SHEFFIELD.

In view of the references in the discussion at the last meeting of the Illuminating Engineering Society on December 15th to the darkening of the streets, it is interesting to notice that the same question was debated at a meeting of the Sheffield City Council on the 13th. Mr. W. L. Angell stated that an order was being prepared prohibiting the use of flash-lamps after an air-raid siren had sounded, and the indiscriminate use of such lamps was deprecated.

Sir William Clegg said that in the three months ending December 11th, 1915, 11 men, no women and four children had been knocked down by trams; the corresponding figures for the period ending December 11th, 1915, were much greater, namely, 42 men, six women and two children, and seven cases proved fatal.

Dr. W. H. Fordham said the prevailing conditions were a source of danger. Other cities and towns were taking steps to relieve the darkness. He suggested special electric lighting at dangerous corners, which could be automatically extinguished on receipt of an alarm.

SOME EVENTS DURING THE VACATION, WITH SPECIAL REFERENCE TO WAR ECONOMIES IN LIGHTING.

BY L. GASTER.

(Honorary Secretary of the Illuminating Engineering Society.)

(Address delivered at the meeting of the Society held at the House of the Royal Society of Arts, 18, John Street, Adelphi, London, W., at 5 p.m., on Friday, December 15th.)

It is customary for the Hon. Secretary, at the opening meeting of the Session, to give an account of progress during the Vacation. In the past, on such occasions, there have been references to the participation of the Society in various International Congresses. Now, unhappily, there is no such international co-operation to record. But a number of recent events illustrate very clearly that in the present times there are opportunities as fruitful as in times of peace—and possibly even more so—for the exertion of the influence of the Society.

Before proceeding with this address, it is my duty to mention the very sad loss that the Society has sustained in the death of Professor Silvanus P. Thompson, our President during the first four years of existence of the Society. At the Annual Meeting in May Professor Thompson presided with all his usual enthusiasm and charm. His death, which occurred only a few days afterwards, came as a painful shock. A tribute to Professor Thompson's noble personality and distinguished abilities was paid in the notice that appeared in the official organ of the Society after his death.* It is sufficient now to say that we owe him a debt of gratitude we never can forget, and that his memory will be preserved so long as the Society exists.

Development of Illuminating Engineering in the United States.

In common with all other scientific societies our numbers have been affected by the withdrawal, either for service with the Colours or for other special war work,

of members whose services would have been very welcome at the present juncture, and the whole trend of circumstances is directing our activities into new fields.

Many aspects of lighting are necessarily in abeyance, but it is gratifying to see that in the United States illuminating engineering is making steady progress. At the recent Convention an interesting series of papers and reports was presented, and the Course of Lectures arranged at the Pennsylvania University will furnish a useful precedent for us in the future. Among other points of interest is the Report on Nomenclature and Units. This list of terms and symbols will require consideration in European countries. Of special interest is the decision taken to adopt the "lumen" as a measure of the illuminating power of all kinds of lamps—a matter which, it is hoped, will receive the attention of our Society early in the new year. Yet another indication of progress is the decision of two States, Pennsylvania and New Jersey, to adopt legislation on the illumination of factories, in which the intensity required for various purposes is specified. The requirements appear to be broadly in agreement with those of the Departmental Committee of the Home Office in this country.

In other directions, notably in connection with street and spectacular lighting, progress has also been made. The method of flood-lighting, according to which the faces of buildings or signs, &c., are completely illuminated by a projected beam from a concealed source, appears to be coming popular. This method formed an important feature in the highly novel lighting devices employed at the Panama-Pacific Exhibition.

* *Illuminating Engineer*, June, 1916, pp. 145-146.

We in England are at present debarred from the development of the artistic and decorative sides of exterior lighting, but, with a view to the future, it is well to make note of the new methods that are being introduced elsewhere.

In other directions there are developments now taking place which may have a profound influence in the future. We see everywhere tendencies towards co-operation, and, while some of these are only indirectly associated with illumination, they suggest possibilities of similar action in our own sphere.

The movement towards economy in fuel has led to many new experiments being tried. In his address to the deputation from the Board of Scientific Societies on December 1st Lord Crewe referred to an extensive survey now being made of the coal-fields in this country, with a view to ascertaining the basis on which they can be most economically utilised. The steps taken towards the linking up of gas and electric supply stations in various districts illustrate the change in attitude towards co-operation.

The present circumstances have also led to various forms of co-operation between gas and electrical supply. A number of authorities already supply gas and electricity in this country. In a recent Paper before the North British Association of Gas Managers, Mr. J. W. Napier gave an account of the very favourable experience of the authorities at Alloa where gas-driven electric generators are in use. The question of the best method of applying gas for the production of electricity, whether in the form of gas-engines or gas-heated boilers, hardly falls within our province. But the consideration of such problems may, we will hope, lead to fuller co-operation in the lighting field.

The position was summed up by Dr. Charles Carpenter at the meeting of the South Metropolitan Gas Co. last August, when he said:—

"I do not know whether the policy adopted by Parliament of putting suppliers of gaseous and electric energy into competition has not had its day; it may have. If one were to begin again, one would not do what one is doing to-day, viz., put up a large station to produce electric energy and another for gaseous energy. We should look to see whether these supplies should be undertaken separately, or whether

there was not a great deal to be said on the point of economical working for running them together."

Daylight Saving.

One of the most noteworthy and revolutionary changes made, largely with a view to saving in fuel, is the Summer Time Act, generally known as "Daylight Saving Act," which came into force for the period from May 21st until October 1st in the present year. The effect on supply companies naturally varies much, according to the locality and the percentage of gas or electricity used respectively for lighting and fuel. In purely residential districts the diminution in output has been considerable. In Ealing, for example, it is stated to have been as much as 23 per cent., and other companies similarly affected have remarked that the Act ought to be termed the "Artificial Light Saving Act"! According to some figures recently given by Mr. A. E. MacKenzie before the Manchester Local Section of the Institution of Electrical Engineers, the saving in the purely residential district of that city was 13 per cent., but in the industrial districts there has been, since the Act was passed, an actual increase of 8 per cent. Taking the entire field of supply, the saving is of the order of 1—1½ per cent. only, but even this is estimated to have led to an economy, in Manchester, of 400—600 tons of coal in the course of a year.

It would be most instructive if a complete survey of the effect throughout the country could be made, so that the resultant approximate actual saving in fuel could be estimated. The measure has been carried out with relatively little inconvenience, and may be permanently adopted after the war. At the present time, therefore, we should be prepared by gaining as full information of its effects as possible. Such an inquiry should not be confined to the actual fuel saving. It would be useful to ascertain if the change in habits of the people had been on the whole beneficial, and the effect of the measure on conditions of work in factories and offices. If it could be shown that the percentage of absentees through sickness had been materially diminished, this in itself would be a most important result, which would

no doubt influence future decisions regarding premises into which the access of daylight is always deficient.

Associated with such an inquiry, again, is the whole question of the design of buildings with a view to maximum admission of natural light, and the comparative value of the various devices for improving the light in existing buildings (the use of prismatic glass, mirrors, &c.). As a measure of economy such devices, which prolong the hours during which artificial light is not needed, deserve much more scientific study than they have yet received in this country. These problems have an important relation to the work of the Committee of the Society on Natural Lighting in Schools, which was summarised in a Report issued shortly before the war, but has not since been carried further owing to lack of funds.

Mr. F. W. Willcox, in a recent letter to the *Illuminating Engineer* and other journals, has pointed out the need for an accurate comparison of the initial cost of making special provision for daylight in buildings, such as specially designed windows, and the consequent extra internal heating to maintain the correct temperature. An equally important matter is the diminution in daylight caused by the practice of obscuring skylights, &c., in order to comply with the lighting regulations. If it could be shown—what is probably the case—that the cost of providing efficient blinds, which could be drawn down in the evening and released in the day, was small in comparison with the running saving in artificial light so caused, this in itself would be an important result.

Economy in Artificial Light.

I come next to the question of economy in artificial light. The national importance of economising in fuel supplies has led the Board of Trade to issue circulars requesting consumers to diminish their consumption of gas and electricity for lighting, and inviting gas and electrical supply companies to co-operate in bringing about a 10 per cent. reduction. This matter was referred to in a recent editorial in the *Illuminating Engineer*.

It was stated then, what I am sure will meet with general agreement, that

judicious economy in lighting, by which is meant prevention of the waste of light, and its application in practice in the most efficient manner, is one of the main objects of our Society. The advice widely placarded on the official notices throughout London—"Don't Waste Coal, Gas, or Electric Light"—meets with our full approval.

It is, however, necessary to supplement this advice by more detailed instructions as to how this waste can be avoided; and here our Society, which is constantly engaged in studying the proper methods of using light, is already doing national service. If the advice contained in the little pamphlet issued in 1913, entitled "Light and Illumination: their Use and Misuse," were generally followed a very large saving, accompanied by an improvement in the conditions of illumination, would be at once secured.

On the other hand, we have abundant evidence that the mere diminution of illumination, in cases where it is even at present insufficient for the purpose in view, is false economy. I have so frequently referred to the conclusions of the Home Office Report on Factory Lighting that good illumination is essential in factories and workshops, and that defective illumination leads to diminished output, spoiled work, and an increased number of accidents, that it seems hardly necessary to go over this ground again. I should like to mention, however, that these conclusions are strongly endorsed in the series of bulletins issued by the Committee on the Health of Munition Workers during the present year, particularly in No. 9 relating to Ventilation and Lighting of Munition Factories, and No. 15 (just issued) on the Effect of Industrial Conditions on Eyesight. No one, at the present moment, would think of handicapping our munition factories by restricting the supply of gas or electricity, either for power or for lighting, and the same applies to all productive work, both from the economic and hygienic standpoints.

A well-considered scheme of economy, therefore, can be made effective only through the systematic education of people to appreciate the proper use of light, and the Authorities would greatly assist the objects they have in view if

they were to make use of this Society to prepare definite instructions on the subject to various classes of the community.

I may say that I have reason to believe that suggestions from us in the proper quarter would receive sympathetic consideration.

The education of the public as to what constitutes good lighting is a most important duty at the present time; and the technical press, which has so widely noticed our work since the commencement of the illuminating engineering movement, can do good service by keeping this matter constantly before the notice of their readers.

Meantime we have before us every day many examples of wasted light. We see lamps in shop-windows shrouded with coloured paper or obscuring lacquer so that a mere fraction of the light produced is allowed to penetrate through the screen and carry out any useful purpose. In interiors we see old and wasteful types of lamps still employed, or lamps used without any adequate form of shade or reflector, throwing a large part of the light where it is not required.

One difficulty which one meets in making economies is that of obtaining a proper supply of the best types of reflectors. The shortage is presumably due largely to the exceptional demands of munition factories, and to limitations in manufacturing facilities or material. Some members may be able to make suggestions on this point. It may be that this is a case in which we have to submit to present inconveniences, but it should be clearly understood that this is in no sense an economy. The cost of installing proper lighting appliances is small in comparison with the saving over a number of years in gas or electric consumption, not to mention the effect of unsatisfactory lighting on the output and quality of work.

Anything that can be done to encourage the development of lighting appliances of which we are lacking would be in the nature of an investment, since the life of such appliances is certainly much in excess of the lamps with which they are used. It would be interesting if makers could give approximate particulars of the life of reflectors of various

kinds under average conditions; if they would state what can and is being done to collect and renovate reflectors, which, on account of surface deterioration, would otherwise be scrapped; and what other available materials could be suggested from which useful shades for temporary use could be made.

Assuming the need for economy, we are still in want of more definite information on the intensities of illumination actually required for various processes. This point was discussed at the time of the issue of the Home Office Report, and it will be recalled that in the American Code on Factory Lighting a rough classification of the illumination needed for safety and convenience, and for rough and fine manufacturing operations, was attempted.

So far, however, there has not been an exhaustive scientific investigation, based on actual results achieved with varying amounts of illumination. It is common knowledge that, with the introduction of more powerful lamps during the last ten years, the standard of illumination in interiors has steadily risen. There is good ground for thinking that this progressive change is well justified, and that the order of illumination prevailing in the days of carbon filament electric lamps and flat flame gas burners was often too low for modern strenuous work. In many instances it was certainly under a foot-candle.

Yet, from the standpoint of economy, it would be very important to determine the approximate upper limits, beyond which no gain in output or quality of work is to be obtained. A most instructive experiment is being conducted by the Commonwealth Edison Co. in the United States. A factory is being lighted in accordance with the best modern practice, and arrangements are being made for increasing at will the illumination to three times its present value. The experiment will be carried on for at least four months, the two methods of lighting being used alternately at intervals of a month, and a careful check of the output and quality of work kept throughout the entire period.

Now the Committee on the Health of Munition Workers has been carrying out many detailed investigations into the effect on output in munition factories of

changing hours of work; and similar researches undertaken in France, and described in the Chadwick Lectures recently delivered by Professor William Stirling, showed beyond doubt that if the hours of work are increased past a certain point the output first becomes stationary and ultimately falls off.

Illuminating engineering in relation to factories should be regarded as an important branch of the admirable "Welfare Work" carried out under the Ministry of Munitions, with which it has much in common. From the commencement of the movement we have regarded illumination as a necessity in modern life, and inquiry into its proper use as a public service. This idea was emphasised in the closing words of Professor Silvanus Thompson's Inaugural Address to the Society in 1909. We have found, too, as those engaged in the Welfare Movement have found, the necessity for patient education of public opinion through our meetings and through the scientific and technical press. It would be most instructive if, while detailed investigations into other variations in conditions affecting the health and efficiency of munition workers are being made, the influence of

to minimising the danger from hostile aircraft.

At the same time we cannot help being conscious that, if the assistance of those who have made a study of illumination for years were more effectively utilised, it might be possible to improve on the present arrangements in many respects—to make economies that would be very desirable at the present moment, and to provide conditions of illumination which, while meeting the views of the Authorities, would make the streets more tolerable for traffic and pedestrians.

When the diminution in illumination was first undertaken we offered our services to the Authorities. Subsequently, early in 1915, a Joint Committee was formed with a view to aiding the Authorities in this matter, and we are still anxious to be of assistance. Two years have elapsed, and there is now opportunity to judge the effect of these lighting conditions. One fact that has been strikingly brought out is the increase in the number of accidents due to motor vehicles which, for the years 1913 to the present time, were stated in the House of Commons, in reply to a question by Mr. Gilbert, to be as follows:—

Year.	Total number of Fatal Accidents in the London Metropolitan Police District, caused by motor vehicles of all kinds.	Total number of Non-fatal Accidents in the London Metropolitan Police District, caused by motor vehicles of all kinds.
1913*	424	13,153
1914	493	14,638
1915	666	16,366
1916 to Oct. 31st ..	509	11,827

* Taken from the Returns on Street Accidents caused by vehicles during 1913, presented to the House of Commons, February 26th, 1914.

changing conditions of lighting could also be studied.

Lighting Conditions in the Streets.

I come now to another aspect of economy in lighting, namely, the diminished illumination in the streets. I wish to make it clear, as I did when this matter was first mentioned at the opening meeting of the Society in the autumn of 1914, that we are all willing to abide loyally by any conditions demanded in the interests of the safety of the country, and I do not mean to discuss this matter in relation to precautions which the Authorities consider necessary with a view

In an Editorial in the last number of the *Illuminating Engineer*,* it is pointed out that this increase has taken place in spite of a number of factors which should tend to diminish accidents, such as the diminution in the number of people and vehicles in the streets, the slower speed of traffic, the greater care exercised by drivers and pedestrians, and the tendency to greater sobriety since the outbreak of war.

The relation between diminished illumination and accidents, therefore, deserves careful study, and the following

* *Illuminating Engineer*, Nov., 1916, p. 334.

additional information would furnish useful data for drawing conclusions on this matter:—

- (1) The returns of the accidents during *each month* of the period referred to above.
- (2) The respective numbers of accidents in each month during the day, and between sunset and sunrise.
- (3) The dates at which further restrictions in lighting have been introduced.
- (4) The approximate figures for the number of licensed motor vehicles, tramcars, &c., plying in London in each month.
- (5) The dates at which restrictions, if any, in the speed of such vehicles, have been introduced.

The importance of the matter was emphasised at the Conference called by the London General Omnibus Co. on Friday, December 1st, with a view to forming a "Safety First" Campaign Council for the Metropolitan area. Mr. Blain, the Operating Manager of the London General Omnibus Co. and the originator of the Conference, explains that the movement had its origin in a general desire to promote safety in the streets even before the present darkening took place. The present conditions, however, make the movement especially welcome, and it is not surprising that at the meeting most of the speakers referred to the anomalies in the treatment of lighting in different districts.

There are many different aspects of the subject to be considered. In addition to the question of accidents, there is the choice of methods of dimming the lights which will waste as little gas and electricity as possible. There is also the question of accidents, referred to above. And there is also the very important consideration that the mere slowing down of traffic (in some streets to a walking pace) is, especially at busy times of the day, a great economic loss.

The recent fog in London, and its attendant inconveniences, led to the lighting conditions being much discussed in the Press; and many suggestions, more or less practicable, have been made, for example, that two alternative systems of lighting should be provided so that in the event of a fog the illumination can be temporarily increased, the provision of special red lamps on refuges, and the more general whitening of the kerbs and other obstacles.

It is evident, however, that the greatest

measure for the safety of the streets would be the more scientific darkening of the lights. One undesirable feature of the present arrangements, to which attention was called in the discussion of the Society in 1914, is the extreme "patchiness" and uneven distribution of light, giving rise to severe contrasts of light and darkness. There seems reason to believe that this inconvenient effect has not been deliberately sought for any purpose, and that it is merely the accidental result of the crude methods of shielding the lights now being employed. One of the first points to receive attention in a scientific inquiry would doubtless be the elimination of these severe contrasts in light and shade, which are distracting alike to drivers and pedestrians, and are probably not desirable, as forming distinct marks on the roads when viewed from above. The great variety in method prevailing in different districts apparently arises through the fact that a number of different authorities are concerned with the matter, whose directions are often more or less conflicting. In addition, it would appear from the results that the actual measures taken are often decided by people who have little experience of lighting problems, and do not appreciate the great difference in convenience occasioned by apparently small variations in procedure in dealing with public lamps.

At the commencement of this address I referred to the many unprecedented "linking up" measures, many of which would have been considered impracticable in peace time. Now that the darkening of London has been experienced for over two years, is it not time for a comprehensive inquiry to be made, and for the establishment of a central authority to deal with the matter, taking into account *all* the various aspects of the matter, and bringing about greater uniformity in the measures taken throughout London and possibly throughout the entire country? I believe that in this way it would be possible, not only to get better results from the standpoint of the public safety, but to make a very considerable saving in gas and electric consumption. Many of the present methods, which involve darkening almost the entire surface of the globe of a powerful lamp, are most unscientific and uneconomical, and at

present there is apparently no body whose duty it is to see that better methods are adopted.

Gas and electric supply companies are, to a great extent, tied by their existing contracts, and neither they nor the Borough Councils are inclined to embark on rearrangements of lighting systems which may afterwards be vetoed. They are also perplexed by their efforts to meet the wishes of various authorities, some of whom consider the interests of traffic, others economy in lighting, others only precautions against hostile aircraft, but none supplying a definite specification stating how *all* these requirements can be most economically and efficiently met.

Our Society, which numbers amongst its members engineers concerned with both gas and electric supply, makers of lighting appliances, and experts in touch with various Government Departments, and which has made a special study of lighting problems and the compromise between different aspects of lighting which they involve, should be in a particularly favourable position to give assistance in this matter.

Research in the Lighting Industry.

In the final section of my address I wish to pass on to the general question of experimental research in illumination. It will be recalled that at the Annual Meeting of the Society last May the Research Committee presented a Report containing a list of investigations with which the Society might usefully occupy itself. In common with other scientific bodies, we are under the difficulty at present that many of our most able members are devoting their time to special researches for the Government. I would like to add that those of our members who are associated with Government Departments have shown every desire to encourage the scientific treatment of problems related to optics and illumination. In several cases efforts at improvement are being made, and if success in these directions is attained it will be very largely due to their enterprise. Apart from the efforts of individual members in such directions, two committees of the Society have been formed which are now at work on researches of this nature. We have also

formed a committee to consider the question of illuminating glassware.

We feel, however, that we have still surplus energy to devote to other work of industrial importance. I have referred to a few researches of value, but there are many others, and I would remind members that we are always glad to hear suggestions as to problems that deserve study.

One of the most encouraging signs during the past two years has been the growing recognition of the need for scientific and systematised research, and we appear now to have reached a stage where investigations of value will receive sympathetic consideration from the Government, which is in a much better position to give practical support.

The formation of the Committee of the Privy Council for Scientific and Industrial Research was a most important step, which has already led to various industrial researches being undertaken. The statement made by Lord Crewe before the deputation from the Board of Scientific Societies on December 1st seems to open the way for much greater developments. Some of the most important points in his statement are:—

(1) The conversion of the Committee on Scientific and Industrial Research into a separate Department, established by Royal Charter under the title of the Imperial Trust for the Encouragement of Scientific and Industrial Research.

(2) The allocation to the Trust of a grant enabling four to five times the present expenditure on research to be made during the next five years.

(3) The announcement that money devoted by firms to research, under certain conditions, can be regarded as "working expenses," and is therefore free from income tax and excess profits tax.

It seems to me, therefore, that at the present moment there is before us a great opportunity for initiating research in the lighting industry. We have in view a number of specific researches with which to approach the Authorities.

In addition to this, in view of the magnitude of the lighting industry which we represent, and its vast national importance, there seems to me good ground for seeking to establish some body, working in co-operation with the Authorities, and having for its aim the development of the industry as a whole.

We see, in the new movement for the encouragement of research, an indication that better times are coming. It is for us to grasp the opportunity; for members to co-operate with us in undertaking researches, in interesting others, and spreading the movement to a wider circle;

and for manufacturing concerns and gas and electric supply companies to recognise the value of the work that the Society is doing, and to give us fuller support in order that we may do greater things in the future

DISCUSSION.

The CHAIRMAN then called upon Mr. H. E. Blain, Operating Manager of the London General Omnibus Co., to open the discussion.

Mr. H. E. BLAIN said he was at present very much concerned with the Safety Campaign which had recently been inaugurated for London and from that point of view the street lighting problem was of very great interest. If the Society could put forward some scientific suggestions for the consideration of those dealing with the "Safety First" Campaign, they would be exceedingly useful. The whole difficulties in the streets at present were due to the anomalies to be found in different districts for the street lighting. In some places there was practically no lighting at all, whilst in others it was of comparatively great intensity having regard to the prevailing conditions. Certainly there was considerable room for greater science in dealing with the problem as a factor in reducing the large number of fatal accidents that were now taking place in the streets.

Mr. F. W. WILLCOX stated: There were two points that stood out in his view of the matter of the present street lighting arrangements. The first point was the question of the control of the lighting circuits. The present street lighting conditions in London justified serious criticism in the apparent neglect they show of utilising engineering methods in dealing with the problem. It had always seemed to him that some method of central station control should be provided so that the lighting could be dimmed when it was necessary to dim it and could be maintained at full brilliancy at all other times. Under present arrangements, the streets are dark at 3 or 4 o'clock in the afternoon just as much as they are at midnight. There certainly

is no military necessity for the lights being darkened in the afternoon or early evening—the time of the day when there is a large amount of traffic and business requiring the best lighting facilities. If not with gas, then surely with electric lighting (considering the readiness with which electric current can be controlled and distributed) it should have been possible to have provided arrangements for separate circuits of supply for the street lamps, so that a very definite control could be maintained over the lighting, permitting the lights to be extinguished, dimmed or kept at full power in accordance with the conditions or time of the day. A series circuit with constant current regulation, of the pattern which is universally employed in the United States and Canada for street lighting, would have made it a simple matter to have operated separate circuits of street lighting lamps of low or high power, which could be switched on from a central point and definitely controlled therefrom in any degree of dimness desired at any time, while leaving the full brilliancy of the lamps available for use at all other times. If on no other plan, something of a temporary arrangement might have been adopted, employing overhead cables or wires strung on wooden posts placed along the curbing for low candlepower lamps, connected to and regulated from the central station. Such a system of "marker" lighting would have made it very safe for street traffic and for pedestrians.

The second point was the neglect of scientific methods of redistribution of the light under the reduction of light regulations. It certainly was an unfortunate omission on the part of the authorities not to utilise the aid which the Illuminating Engineering Society could have offered in dealing with this problem of light distribution. Apparently the whole

problem was dealt with in such a hurry and in the expectation that the war would not continue for a long period, and that, therefore, any arrangements would only be temporary and need not be dealt with as a serious and definite problem in illumination. The failure to utilise Illuminating Engineering principles has resulted in a very unsatisfactory condition of illumination as everyone knows. The eye is an adaptable instrument which can work satisfactorily under various degrees of illumination so long as the illumination be uniform. The main problem therefore in dimming and reducing the light in the streets was one of ensuring uniformity of light with the reduction of intensity.

If this had been done (and it could have been done with any real engineering consideration of the question) the dangers and difficulties of street travel would not have been seriously increased. It is the extreme patchy condition of lighting with bright spots, alternating with absolutely black spots, glaring lights and then intervals of absolute darkness, that is responsible for the present troubles with the darkened lights of London.

He would not attempt to labour these points further but only desired to point out that the engineering factors involved in the question of proper light distribution arrangements and the central control of the lighting were well known, and that it was merely a question of applying such engineering arrangements and adaptations to the solution of the problem.

Mr. A. CUNNINGTON agreed that something on the lines suggested by Mr. Willcox ought to be done. There was a simple solution of the difficulty in districts where the lighting had been reduced by switching out every alternate lamp and darkening the globes of those in use. In such cases it was quite feasible to fit lower candlepower lamps in the globes not used, and to switch them on in emergency, at the same time switching out the other lamps.

At Waterloo Station that scheme had been adopted. Previous to the war there were two lamp circuits on all the platforms, but during the war they had had to cut down the ordinary lighting to a half so that one circuit was turned out. Recently the circuit that had been out of

use had been equipped with low candlepower lamps and the authorities had given permission to use the full power lamps at ordinary times, provided that these were switched off and the low candlepower lamps brought into use when the usual message came through that there was the likelihood of an air raid. That seemed a feasible solution of the street lighting problem wherever lamps were controlled from a distance, and it would not be difficult or costly to carry out.

An instance that came under his notice recently showed what economies could be made by the use of blinds instead of permanently darkening windows. A skylight had been darkened early in the war, the result being that a large amount of artificial lighting had to be used during the daytime. It was found that by cleaning the paint off the skylight and substituting blinds, the cost of the blinds was counterbalanced in ten weeks by the saving in artificial lighting.

A question just touched upon by Mr. Gaster was that of reflectors. The difficulty of getting them just now had induced him to consider the question of renovating old reflectors. On the South-Western Railway they had adopted extensively the plan of coating old reflectors with ordinary white enamel. Measurements of illumination under these renovated reflectors showed that it was within a few per cent. of the illumination with new reflectors. He admitted that they did not last so long as new ones but as an emergency device it was worth considering.

Mr. S. R. MULLARD, speaking as one engaged in munition work, suggested that all possible means should be adopted to impress the importance of good lighting in such factories upon the authorities.

Mr. H. WYLD (Borough Electrical Engineer, Hampstead) said the reason why the street lighting had been dealt with as it was in London was because local authorities wished to avoid any possible expense at the present time. He agreed, however, that the present lighting arrangements in London were shameful. In the first instance the lighting authorities of London were asked

to attend a meeting presided over by Sir Edward Henry on behalf of the police and the Admiralty, and they were told that they would receive instructions from the Admiralty through the police in their respective areas. These instructions had to be carried out whether the local authorities liked them or not. He had had constant trouble in trying to get a little better illumination in various parts of his borough where it was felt to be really necessary, such as street corners and important junctions, but nearly every time he put forward any suggestion the police inspector in charge of his district said that it was against the instructions and he could not allow any more light.

The effect of the Daylight Saving Act varied very much in different parts of the country, and in Hampstead it varied according to the size and nature of the premises. He had divided the district into four sorts of premises, from large houses to small flats, and the average of about a hundred examples showed that the accounts varied from about 15 per cent. to 32 per cent. At the same time he could not say that he had experienced anything like such a reduction on the output of the station. Indeed the output had only diminished by about 11 per cent., due to the increase in the heating and cooking load.

The wisdom of asking consumers to curtail their consumption naturally did not appeal to him as a supply station engineer, anxious though he was to obey all instructions.

Whilst he did put out a notice asking consumers to curtail their consumption, the Gas Company put a very ingenious notice on the back of their accounts suggesting that people should curtail their *lighting* consumption but increase their total consumption by using more gas for heating and cooking.

Mr. J. S. Dow endorsed what had been said regarding the need for eliminating waste of light, rather than aiming at an indiscriminate reduction.

As regards street lighting no one with any experience of lighting problems could help being struck by the utter lack of scientific method illustrated by the present conditions. This was the more

regrettable because, even before the war, there was available a considerable amount of data, accumulated in connection with the inquiry into the Standard Street Lighting Specification, which would serve as a basis for a minimum standard of illumination essential in the interests of safety. It might be recalled that in main streets a minimum of 0.05 ft.-candles was suggested, in side streets 0.01 ft.-candles, and in country roads 0.001 ft.-candles. At present the illumination in London streets was usually unmeasurable by any ordinary form of photometer. Seeing that the brightness of moonlight is in the neighbourhood of 0.02 ft.-candles it was difficult to believe that a minimum value of say, 0.005 ft.-candles (*i.e.* half the value assigned to side streets before the war) would be a source of danger, while the preservation of even such a value as this would make all the difference to the convenience of traffic and pedestrians.

While the measurement of such low values certainly presented difficulties he thought it was by no means impracticable to devise a rough-and-ready form of test. No doubt the Society could take this up if there were a prospect that, after the work was done, the results would be utilised by the authorities.

The same divergence in practice that characterised street lighting was also met with in tramcars and motor vehicles. In some cases the illumination was almost enough to read by, and fares could be collected without very great difficulty. In other cases it was impossible in some seats to see a coin placed between the fingers. Seeing that fares were collected somehow this illumination might apparently be considered "sufficient for fares to be collected" as the Order stated. But the time taken by conductors in doing so was very much increased, and the present conditions were a constant source of delay and irritation to all concerned. He believed that by attacking the problem in a scientific way, instead of merely obscuring the lamps with lacquer, much better results could be secured.

All these difficulties arose through the fact that the people who gave instructions regarding lighting had little or no technical knowledge of the problem. A central authority, acting under expert advice,

would be the means of saving a great deal of inconvenience and economic loss, and of securing conditions which provided a reasonable margin of safety.

In conclusion Mr. Dow read a passage from the Glossary in *Eclipse and Empire*, in which reference was made to the work of the Society and the need for development of the study of illumination on a much greater scale. There was a tremendous field for useful investigation open to a central body for research in illuminating engineering, such as Mr. Gaster had suggested in his paper.

Mr L. GASTER, replying to the discussion, thanked Mr Blain for his remarks and announced that, in response to the invitation conveyed to the Society through Mr. Blain, a representative of the Society had been appointed to serve on the London "Safety First" Council. In connection with the lighting of omnibusses it was interesting to notice that the experiments made in several cases promised a hopeful solution as the interior of the 'busses was reasonably well lighted and yet the light was prevented from being unduly transmitted into the street.

In regard to the street lighting he was glad to see that those who had joined in the discussion agreed that the present methods were unsatisfactory. When the alterations in lighting were first carried out, no one realised that the war would last as long as it had already done, and the improvised arrangements were regarded as purely temporary. But now when the question of economy and safety had become of such importance, it was surely desirable to profit by the experience of the past two years and to devise methods which were economical, satisfactory from the standpoint of pro-

tection against aircraft, and adequate in regard to traffic and safety. There was a general impression that the amount of illumination in the streets could by now be increased without prejudice to the requirements in respect of air-raids, but the proper distribution of the light was even more important.

He was interested in the suggestions of Mr. Wilcox and Mr. Cunningham. The introduction of a constant current system might be considered a too radical departure at the present time, but a great deal could be done, even on existing circuits, by the substitution of smaller lamps, equipped with suitable reflectors. Some of the arrangements adopted by the railways, to which Mr. Cunningham had referred, were much better than those met with in the streets.

He was glad, also, to have Mr. Wyld's experience, as a Central Station Engineer, on the lighting in his locality. He quite recognised the difficulties of inducing the authorities to make improvements in the present circumstances but hoped that Mr. Wyld would persevere in his efforts. He believed, however, that the only hope of achieving a general improvement lay in the formation of a central controlling body, acting under expert advice, on the lines he had suggested.

The CHAIRMAN, in proposing the vote of thanks to Mr Gaster for his address, said he would like to couple with it a reference to Mr Gaster's unflagging efforts on behalf of the Society during the past year.

It was announced that the next meeting would be held in January when there would be a discussion on "The Lumen as a Basis of Measurement of the Illuminating Power of Lamps."

CENTRAL CONTROL OF GAS LIGHTING IN EDINBURGH.

On November 3rd members of the Edinburgh and Leith Gas Commissioners and of the Edinburgh Corporation Lighting Committee witnessed some experiments on the automatic control of street lamps in a section of Edinburgh by the Alder and Mackay apparatus.

At a conference held after the inspection it was pointed out that the application of this method would be very useful as a means of quick diminution or extinction of light in the event of a Zeppelin raid. In addition it is calculated that if the system were applied to 6,000 lamps in Edinburgh an annual saving of £2,500 to £3,000 would be made.

Mr. H. R. Kempe. Dr. S. A. Vasey. Mr. P. N. Haslidge. Mr. S. R. Bentley. Mr. Chambers Smith.
 Mr. A. E. Haynes. Mr. H. Cooper. (Hon. Sec. and Treasurer of the Circle). Mr. C. S. Phillips. Mr. J. L. Greaves. Mr. J. S. Dow. Mr. A. S. Jennings.



Mr. W. R. Cooper. Mr. L. Gaster. Prof. H. B. Dixon. Sir Henry Miers. Mr. Geo. Springfield. Mr. W. Palmer. Mr. A. T. Dale. Mr. E. Davis.
 (Chairman of the Chemical Department, Vice-Chancellor, Manchester University, Committee Institute of Journalists.)

Photograph taken on the occasion of the Visit of the Circle of Scientific, Technical, and Trade Journalists to Manchester University, December 12th, 1916.

Photo by Ward, Manchester.

A VISIT TO THE UNIVERSITIES OF LIVERPOOL AND MANCHESTER.

(An account of a visit to the Universities of Liverpool and Manchester, and to various factories in the locality, by the Circle of Scientific, Technical, and Trade Journalists, December 10th—13th, 1916.)

It will be recalled that in previous issues of this Journal accounts were given of the visits paid by the Circle of Scientific, Technical, and Trade Journalists to the Imperial College of Science, London, and subsequently to the Universities of Leeds and Sheffield.*

A similar arrangement was next made by the Universities of Liverpool and Manchester, who invited the Circle, as the section of the Institute of Journalists chiefly interested in these matters, to form a party to visit these two cities on December 10th—13th. Throughout their stay the party were the guests of the Universities. This visit, like those mentioned above, should be most beneficial in enabling technical and scientific journalists to learn something more of the work carried on at the chief educational centres of the country, and to co-operate with them in bringing about a fuller public appreciation of the benefits of technical education and scientific and industrial research.

The party consisted of:—Mr. H. Cooper (*British Medical Journal*), Mr. W. R. Cooper (*Electrician*), Mr. A. T. Dale (*Plumber and Decorator*, &c.), Mr. E. Davis (*Chemical Trade Review and Chemical Engineer*, &c.), Mr. J. S. Dow, Mr. L. Gaster *† (Chairman of the Circle of Scientific, Technical, and Trade Journalists), Mr. J. L. Greaves† (*Stationery World*, &c.), Mr. A. E. Haynes (*Timber Trades Journal*, &c.), Mr. P. N. Hasluck*‡ (Hon. Sec. and Treasurer of the Circle of Scientific, Technical, and Trade Journalists), Mr. A. S. Jennings‡ (*Decorator*, &c.), Mr. Bernard Jones ‡ (*Building World*, &c.), Mr. H. R. Kempe (*Electrical Review*), Mr. W. Palmer‡ (*Laundry Journal*), Mr. S. C. Phillips† (*British*

Paper Maker, &c.), Mr. H. E. Philpott (*Illustrated Carpenter and Builder*), Mr. S. Rentell (*Electricity*), Mr. H. Richardson (*The Engineer*), Mr. Chambers Smith (*Municipal Engineering*), Mr. Geo. Springfield * (Mem. Executive Committee of the Inst. of Journalists), and Dr. S. A. Vasey (*The Lancet*).

Among those who expressed their regret at being unable to join the party owing to pressure of editorial or other duties, &c., were:—Mr. E. J. P. Benn (*Hardwareman*, &c.), Mr. C. Chisholm (*System*), Mr. Gilbert Wood (*Architect and Contract Reporter*), Mr. T. C. Elder (*Engineering Review*), Dr. R. A. Gregory (*Nature*), Mr. Harold Jeans (*Iron and Coal Trades Review*), Mr. A. J. Mundella (Chairman of the London District of the Inst. of Journalists), Mr. A. E. Pendred (*The Engineer*), Mr. J. Meyjes (*Ironmonger*), Mr. W. A. Standing (*Motor Cycling* &c.), Mr. Sydney Walton (Welfare Dept., Ministry of Munitions of War), and Mr. H. W. Wills (*The Builder*).

Visit to Liverpool University.

The party arrived in Liverpool on the evening of December 10th. After dinner there was a reception at the Adelphi Hotel, where Professor Gonner (the Deputy Chairman of Senate of Liverpool University) and Mr. Carey (Registrar of the University) welcomed the party. Professor Gonner expressed the regret of the Vice-Chancellor at being unable to be present owing to indisposition, and gave an account of some of the chief features of the work of the University to be visited on the following day.

* Fellow of the Institute of Journalists.

† Representing the British Association of Trade and Technical Journals.

‡ Member of the Committee of the Circle of Scientific, Technical, and Trade Journalists.

* *Illum. Eng.*, June, 1916, p. 204.

Illum. Eng., October, 1916, pp. 314–322.

Address by Professor Herdman :

On arrival at the University on Monday the party were met by Professor Herdman, who also expressed the regret of the Vice-Chancellor that he was unable to be present to welcome the representatives of the Press. At the University they all realised the great need for making their work known to a wider circle; they welcomed the co-operation of journalists in this direction, and hoped that such visits would be the means of promoting closer bonds between the Universities of the country and the scientific and technical press.

Proceeding, Professor Herdman referred to the important statement made by Lord Crewe to the deputation from the Board of Scientific Societies on December 1st. Pure and applied science were equally essential. No one could foresee the ultimate application of experimental work in pure science; and many of the great discoveries, such as those of Davy, Faraday, Galvani, Oersted, and others, were made without any ulterior motive or hope of reward.

In the Liverpool University both pure and applied science were represented. In addition, much of the work was of special utility to a great shipping and commercial centre like Liverpool. The School of Commerce was undertaken jointly by the City and the University, and the latter had organised courses of modern languages, including Russian, and a department for the study of geography—a subject that was now recognised to have great commercial importance.

In the Engineering Sections a great deal of work was being done for various Government Departments, and close co-ordination was maintained between the University and the various technical schools in the district. Courses for the training of munition workers had been organised.

In another direction, medicine and public health, the University's work was of considerable importance to the City of Liverpool. The School of Tropical Medicine had a direct bearing on the health of the city, in view of the constant arrival and departure of vessels to and from tropical countries, by which the

germs of disease might easily be spread if proper precautions were not taken. The research work of this department had been of great benefit to pioneers in tropical districts, destined eventually to become the home of the white man. In the bacteriological departments work is also being done for the city in connection with the testing of foodstuffs, shell-fish, &c., and the detection of anthrax and other diseases of animals, and this laboratory is also recognised by the War Office as the centre for Liverpool and the adjacent district.

Dr. S. R. Vasey (*The Lancet*) made a few remarks on behalf of the visitors, who, he said, were gaining a valuable insight into the work of the leading Universities—work which marked the dawn of a new era in scientific and technical education.

Engineering Departments :

The visitors were then conducted over the Engineering Department of the University. In the section under Mr. J. Wemyss Anderson, attention was drawn to a series of experiments on belts, the vibrations of reciprocating engines, and combined stresses in steel. There is also a special plant for researches in hydraulics, and refrigeration has also been closely studied. In the Mechanical Engineering Department, under Professor Watkinson, a great deal of special work for the Ministry of Munitions is being carried on. This includes Lectures on the Manufacture of Shells, the Training of Munition Workers, Preparation of Gauges for Shells, and Tests of Materials, such as bronze, copper, and steel. It was particularly interesting to notice a number of men in khaki being trained on the premises for work in the R.A.F.C.

A conference is now being held at the University to consider technical education in the district. This matter, and also the question of research in connection with new types of machinery and new processes of interest to the mercantile marine, are being studied in connection with the needs of the great shipping industries of Liverpool.

In the department of Applied Electricity under Prof. W. E. Marchant, the visitors had their attention drawn to other researches undertaken for Government departments or in connection with

industry. With the cooperation of the Electrical Engineer to the Liverpool Corporation a series of tests on buried copper-bitumen cables were in progress. We understand that these experiments are to continue for an entire year, but already useful data regarding the current-carrying capacity of such cables have been obtained.

Work on Magnet Steels is being done in connection with the Institution of Electrical Engineers Research Committee and in co-operation with Sir Robert Hadfield, a point of special interest being the bearing of such researches on the steel used in magnetos for aeroplanes.

We were much interested to see the Globe Photometer, constructed under Prof. Marchant's supervision, in operation. It will be recalled that an account of this apparatus was given by Prof. Marchant in his paper before the Illuminating Engineering Society in 1910.*

Address by Alderman Alsop (Chairman of the Liverpool Education Committee and Pro-Chancellor of the Liverpool University).

Following this inspection the visitors were entertained to lunch by the University, Alderman Alsop, who in the above functions represented both the University and the City of Liverpool, presiding.

Alderman Alsop gave a short address expressing a welcome to the visitors, in the course of which he showed the close relation of much of the University's work to the activities of Liverpool, although it had also a wider application.

It would be found that most of the Universities had a direct bearing on local industries. For example, Leeds and Manchester were interested in textile manufacture, while Birmingham and Sheffield had long been associated with engineering. In Liverpool, on the other hand, the chief interest was its shipping trade which made the city a great commercial centre. The University had therefore taken up such subjects as the teaching of languages, geography, history, and economics, which had great commercial importance.

The School of Tropical Medicine, again, had been a great aid to commerce, for

the researches of the School had made it possible for white men to open up and live in tropical countries without undue loss of life through injury and disease. Chemistry was a subject of great industrial importance in view of the many chemical works established in the vicinity of Liverpool, though not in the city itself.

While meeting all these requirements the University had not overlooked its primary function of providing a liberal education. It had received from individual donors endowments to the value of over a million pounds and also had the support of the Treasury and the Board of Education and the City Council.

Mr. Leon Gaster, in responding for the visitors, said how glad they all were to have this opportunity of learning at first hand what the Universities were doing for science and its application to industry. One great benefit of such visits was the way in which their minds were opened to the practical utility of the most diverse subjects. Medicine for example, which was the subject of special study in Liverpool, had a direct relation to many great engineering triumphs, an instance being the great services which medical men had rendered in connection with the stamping out of malaria during the building of the Panama Canal.

Professor Herdman, who said a few words of welcome on behalf of the Senate, also drew attention to the close relation existing between the work of the University and the life of the City.

In the afternoon the visitors passed rapidly through other departments of the University, including those devoted to geography, tropical medicine, zoology, pathology and bacteriology, and organic chemistry.

Geography, as studied at the Liverpool University, is a more complex subject than many would suppose. Not only is map-making (a subject whose importance has been very vividly illustrated during the present war) studied, but the physical conditions prevailing in different sections of the globe, and the relation of geographical features to the commercial and historical development of nations are considered in their broadest aspects. One could not but be impressed with the

* *Illum. Eng.*, January, 1911.

great practical value of the subject treated in this way.

The School of Tropical Medicine :

At the School of Tropical Medicine, under Professor Stephens, the importance of studying climatic conditions in different countries was again illustrated. Not only are researches carried out on the behaviour of the microbes of malaria, sleeping sickness, and other tropical diseases, but the life-history of the parasites which are responsible for their dissemination, and the conditions of vegetation which favour the development of these parasites are studied in detail. Equally interesting was the inspection of a department in which, by means of models and specimens, the resemblance between the diseases contracted by men and animals was shown. The University possesses a School of Veterinary Science, whose work has been of distinct value to the Military Authorities, and the suggestion was thrown out that the organisation of a Hospital for the Treatment of Animal Diseases would be a welcome addition. In view of its commercial application to the development of livestock as well as its bearing on human health, such an enterprise would seem well worth consideration. At present, we understand, relatively little is known about the origin and treatment of many diseases from which animals suffer, and the losses involved in a single epidemic among cattle must often be considerable.

In the bacteriological department the researches into the study of cases of cerebro-spinal fever, dysentery, typhoid, &c., have a direct military value, and the examination of foodstuffs and of animals suspected of anthrax, tuberculosis, &c., have an obvious relation to public health.

Lastly, reference should be made to the very interesting department in which researches into subjects appertaining to the local sea-fishery industries are carried on. An interesting feature of this section of the work is the well-equipped museum. Reports are constantly received from the local stations on the estuary of the Mersey. This is another subject on which comparatively little is known at present and there are many fields for promising research.

After leaving the laboratories the visitors were entertained to tea at the University Club, where Professor Gonner and other professors were present. Mr. W. R. Cooper expressed the thanks of the visitors, and Prof. Gonner said a few words on behalf of the University.

The party then left for Manchester by an evening train.

Visit to Manchester University.

After arrival at the Midland Hotel, the Vice-Chancellor of the University, Sir Henry Miers, and Professor H. B. Dixon welcomed the visitors at an evening reception, and Mr. C. S. Phillips said a few words in reply.

Address by Vice-Chancellor :

The party were addressed at the University on Tuesday morning by Sir Henry Miers, who traced the progress of the University up to the present day. Originally the Owens College, the University of Manchester now forms part of the Federal Victoria University. In normal times there are about 1,600 students, but during the war the number has fallen to about 420. Most of the departments are actively engaged on war work, the testing of materials being undertaken in the Engineering Department, while in the chemical laboratories there are constant tests on explosive materials and on the products from neighbouring gas-works, from which toluene is extracted.

Sir Henry Miers also expressed his conviction of the importance of continuity in research in pure science, as well as the application of science to industry. Since the outbreak of war many steps in this direction had been taken, but there was still need of arousing amongst the manufacturers of the country a keener appreciation of the benefits of industrial research and the scientific and technical Press could render most valuable service in bringing this matter to their notice.

A visit was then paid, under the guidance of the Librarian, to the Christie Library, which now comprises about 146,000 volumes. The Library originated in a gift to the University of a collection by Mr. James Heywood in 1851. and since that date various other important collec-

tions, including that of the late Mr. R. C. Christie, formerly professor of history in the Owens College, who also bequeathed a sum of £10,000 for the equipment of the Library.

Visit to Chemistry, Physics, and Medical Departments :

Subsequently a tour was made through the Chemistry, Physics and Engineering Departments. A short lecture was delivered in the Chemical Department by Prof. H. B. Dixon, who gave an interesting account of his work on the structure of flames, showing a number of photographic films illustrating the nature of flames caused by explosions. An experiment on picric acid demonstrated the comparative safety of this material unless a detonating ingredient was present. Professor Sir Ernest Rutherford gave an account of the work carried on in the Physics Department, referring particularly to the testing of radium which is now of practical importance for many special purposes as an ingredient in luminous paints. In passing through the laboratories visitors were shown a very fine example of the arc spectrum of iron, obtained from a Rowland grating. In the Medical School a short address was given by Professor Elliot Smith on some of his work on shell-shock. It was explained how in many such cases the disturbed state of nerves and mind is not due to the effect of a particular shell but the cumulative result of strain. The condition of mind of a patient may be aggravated by recollection of some disturbing incident in his childhood; such an impression needs to be removed by the sympathetic and patient treatment of the physician, who endeavours to trace the source of anxiety and to show that it is unfounded. In the Electro-chemical Department the visitors were shown a magnesia crucible prepared in the laboratory. In view of the fact that magnesia melts at about 2800° C. the production of such a crucible is a remarkable feat. It is stated that the industry of fused silica was originated in this laboratory. A visit to the Museum completed the morning's programme.

The visitors were then entertained to lunch by the Mayor of Manchester, an interesting incident being the reception

of Lieutenant (now Captain) Kelly, who had recently been awarded the V.C. and was present, with several relatives, at the luncheon.

In an address to the visitors, the Mayor expressed a welcome on behalf of the City, and emphasised the importance of technical education and research to the nation. Mr. L. Gaster responded for the visitors.

Mr. J. C. Maxwell Garnett, Principal of the Municipal School of Technology, then gave a brief account of the equipment and work of the School, which was to be visited in the afternoon.

Address by Mr. J. C. Maxwell Garnett :

The School of Technology, Mr. Garnett said, was founded in 1824 as the Manchester Mechanics Institution, but had since become a college of University rank. The present buildings were completed in 1903, and the annual cost of maintaining the College is about £50,000; this sum would have been much greater but for the generosity of industrial firms and private persons in founding scholarships and providing equipment.

One function of the School is to provide a university training suitable for men entering industrial employment and, so far as concerns this department of its work, the School is essentially a part of the University of Manchester.

For some years before the war the demand for trained students was exceeded by the supply, and after the war the demand is likely to become greater still. The future of the engineering and other industries will depend in no small degree upon the willingness of young Englishmen to subject themselves to mental discipline and undertake the strenuous study involved in a University course.

The conduct of industrial research, for the most part in co-operation with firms engaged in the industries of South-East Lancashire, forms an important section of the work of the School of Technology. A notable example of the new attitude towards research is furnished by the action of the Governing Body of the School in providing a number of research scholarships, each of the value of £100 a year; and in establishing a new department for post-graduate study and research bearing upon the manu-

facture of intermediate products and finished dyestuffs from coal tar. The Governing Body has also decided to erect new laboratories for demonstration and research in connection with internal combustion engines, and engineering firms in the neighbourhood of Manchester have promised to equip the laboratories with engines to the value of £3,000.

The School is now doing important work in connection with the war, and there is hardly a department that is not doing work for the Admiralty, the War Office, the Munitions Inventions Department, the Board of Inventions, the Royal Aircraft Factory, the Ministry of Munitions or some other branch of the Government. Research work is in progress for others of the Allied Powers. Machines of a new type have been designed in the laboratories of the School and afterwards manufactured on a large scale in engineering works in the district and elsewhere. In co-operation with a Committee of the Manchester Association of Engineers, important experiments on tool-steel have been carried out. These experiments have already resulted in a considerable saving of steel and in increasing the pace at which shells and other munitions can be machined. When the war has been won the country will recognise how greatly the work done by the Universities has contributed to victory. Equally important in the industrial direction are the researches made possible by the liberal grants afforded by the Advisory Council to the Privy Council Committee on Scientific and Industrial Research.

In addition to the university courses there are part-time (mainly evening) classes conducted for those who are constantly engaged in industrial work. Professors find that the interchange of views with such men is of great benefit to their own consulting work, in keeping them abreast of developments.

The buildings and most of the equipment of the School of Technology belong to the citizens of Manchester, and the School has thus a very democratic form of government.

In conclusion, Principal Garnett expressed the hope that the visitors would enjoy their visit to Manchester, and that the visit would lead to still closer co-

operation between the Universities and the industries of the country.

Visit to the Municipal School of Technology.

During the afternoon the visitors made a rapid inspection of the various departments of the School of Technology. It was naturally only possible to survey the arrangements in a very general manner, but all were struck by the excellent equipment and the very varied nature of the work carried on.

The electrical and engineering plant is probably equal to that of any other similar institution in this country. The plant supplies the entire lighting of the building and power can be quickly and easily obtained for research in any department. In the electrical laboratories a number of researches were being carried on, for example the visitors were shown an entire room devoted to high-tension tests on various insulating materials. The arrangements in the electrochemical laboratory were also very convenient, such devices as mechanical pulverisers being shown in operation. In the basement tempered steel was being produced from one of the latest gas furnaces, the temperature being controlled with an optical pyrometer. It was stated that very fine results from this furnace have already been obtained.

A very large area of the ground floor is given up to cotton-spinning and paper-making machinery. In the former section fabrics have been manufactured for aircraft and for other special war purposes. There is also a well-equipped department given up to printing. The programme handed to the visitors on arrival was printed on the premises on paper produced in the paper-making department, and the School undertakes the preparation of all its own stationery and literature.

In the chemical department research on dyestuffs is carried on, and visitors were shown a new insulating material obtained by chlorinating a solution of rubber in carbon tetrachloride. Experiments on the standardisation of rubber products is also in progress. An interesting feature introduced in the chemical laboratories is the partitioning off of a section of the room with glass, so as to form a private

laboratory for the staff. In the case of advanced students it will be practicable for the staff to continue their own experiments and yet to be able to get in touch at once with any student in the main room who is in want of advice.

There are two lifts, one hydraulic and one electric—a desirable feature in such a large building.

Tea was served in the School, after which Mr. Gaster expressed the thanks of the visitors, and the Vice-Principal briefly replied.

Dinner and Reception at Manchester University.

In the evening the visitors were invited to a dinner and reception which took place at the University, Sir Henry Miers, the Vice-Chancellor, presiding. Councillor Simpson, in proposing the toast of the visitors, mentioned that he himself undertook a good deal of journalistic work, and therefore appreciated the services that the Press could render to science and industry. Mr. Leon Gaster and Mr. W. R. Cooper responded for the visitors, and a vote of thanks on their behalf was proposed by Mr. H. R. Kempe. Short addresses were also delivered by the Vice-Chancellor, Professors H. B. Dixon and Sir Ernest Rutherford, and Mr. J. C. M. Garnett (Principal of the School of Technology). All expressed the hope that through such visits the Press and the Universities would be brought into closer relations and that in the future there would be opportunities for constant interchange of views in order that new educational developments might speedily become known to the manufacturers of the country.

The dinner was followed by a short musical programme, kindly rendered by some of the students of the Academy of Music, which was greatly appreciated by the visitors.

Visits to Factories.

Works of the British Westinghouse Electrical and Manufacturing Co., Ltd.:

On Wednesday, December 13th, the morning was devoted to a visit to the works of the British Westinghouse Electrical and Manufacturing Co. In the space available it is quite impossible to do justice to the scale on which work is

carried on. Visitors were equally impressed by the assembling of large generators on the ground floor, the extensive switch-gear department and the assembling, winding and testing of all sizes of transformers. In addition to the very large amount of electrical work going on the company has devoted a section of the works to the manufacture of large calibre shells, for which a number of lathes have been specially designed and manufactured on the spot since the outbreak of war. A great deal of fine work is also being done on shell-fuses and other parts.

In the research departments tests were in progress on the permeability of steels and on the period of break of switches, the arrangements for the latter experiments being particularly ingenious. We were informed that this department will be considerably extended in the near future.

One of the most interesting features of the work of this company is the training of employees, on which a short address was given by Mr. A. P. M. Fleming. It will be recalled that Mr. Fleming, who is an authority on industrial research and the training of apprentices, gave an address on this subject to the Circle earlier in the year. Visitors had an opportunity of seeing how his ideas are being carried into operation. One admirable feature of the training is that apprentices are not required to attend classes in the evening after a hard day's work in the shops. For most men the assimilation of information in these circumstances is quite impracticable. A regular course of instruction is given in a lecture theatre inside the works, and during working hours. The relation between theory and practice is thus very readily shown, and the men so trained can rise by degrees to the highest positions. The Company is already reaping the reward of their enlightened policy in this direction.

The Ford Motor Works:

In the afternoon a visit was paid to the works of the Ford Motor Co. at Trafford Park.

The feature in these works is the remarkable way in which every element in the car has been standardised, and the

highly ingenious and complete use of automatic machinery.

The guiding principle adopted is for the work always to come to the operators instead of the latter having to move from place to place on their job. They remain in the same place, carry out the same operations day by day, and become experts on their particular process. The cars are assembled on a long moving chain, running the entire length of the factory. As the developing car gradually moves along each part is added at the appropriate point, and each element is tested while the work is in progress. Thus at one point the motors are being placed in position. A little further the steering apparatus is being added. Then the mud-guards are seen travelling on a subsidiary chain, being coated and dried in the process and arriving at their appropriate stage in the operations. A little further and the wheels come hopping down a gallery running cross-wise. Two subsidiary railways feed in the hoods and fabric. Finally the complete car passes out into the yard where some ingeniously devised wheels below the pavement set the engine in motion. The driver then takes its place and the car is given a short trial run round the yard, after which, in the great majority of cases, it is ready to go out. Cars arrive at this stage at intervals of about

5 to 10 minutes, and as many as 150 have been produced in a day.

Passing through the works one was struck by the very orderly way in which each process is carried out, the free space round each machine, and the absence of "dumps" of unutilised material. The repair department is organised in a similar way.

At the conclusion of the visit a short account was given of the Welfare Work of the firm, which has many unique features. An exceptionally high wage is paid, and in addition workers receive a bonus after six months if their conduct during this period has been exemplary. There is a medical department on the premises to which any injured workman must at once report in the event of an accident. A careful record is kept of each operator's health and inquiries are at once instituted if he fails to present himself for work.

Such care, we believe, is amply repaid by results.

In conclusion it only remains to be said that everything possible was done to make the visit enjoyable and instructive. The party returned to London feeling that they had witnessed another important section of the valuable work being done at the leading Universities, and much impressed by the great commercial and industrial development of the two cities.

EDUCATION AND DEMOCRACY.

In his inaugural address to the Fifth Annual Conference of the Educational Association, which opened on January 2nd, Mr. A. L. Smith, Master of Balliol, emphasised three important reforms in education, namely, the continuation of education of children above the ages of 13 and 14, the need for improvement in the position and prospects of teachers, and the organisation of the scholarship system.

One of the most hopeful signs was that an interest in education was spreading to the working classes. Experience showed that better workmen were secured by education than by setting lads to work at an early age. If we were to repay the sacrifices of the Dominions by a true and closer union there must not be, in this federation of democracies, a democracy profoundly uneducated at the centre, and unless we made proper use of our opportunities now we should not be, in the true sense, victors in this war.

TOPICAL AND INDUSTRIAL SECTION.

[At the request of many of our readers we have extended the space devoted to this Section, and are open to receive for publication particulars of interesting installations, new developments in lamps, fixtures, and all kinds of apparatus connected with illumination.

The contents of these pages, in which is included information supplied by the makers, will, it is hoped, serve as a guide to recent commercial developments, and we welcome the receipt of all *bona-fide* information relating thereto.]

ANOTHER MAZDA REVOLVING SHADE.

About a year ago **The British Thomson-Houston Co., Ltd.**, introduced an ingenious advertising novelty in the form of a revolving shade. This was intended for use with table, desk and other fittings in which the lamp holder is in an upright position. When the lamp was switched on, the shade rotated owing to an upward current of air heated by the lamp impinging upon a fan disc attached to the upper part of the coned shade and pivoted upon the tip of the lamp. This device could not, of course, be used with pendant lights, but the Company has now produced an adaptation of the design that permits of its attachment to plain pendants.

The accompanying illustration shows the appearance of the shade when in position. When the lamp is switched on, it illuminates the coloured shade, which immediately commences to revolve, the effect being both striking and attractive. If the adapted pendant be

placed in a sunny position, its shade will rotate during the hours of sunlight without the lamp being lighted. The rapidity with which the shade revolves depends upon the velocity of the heated air current, so that the greater the wattage absorbed by the lamp the greater the speed attained.

Readers in the Trade can obtain these shades upon application to the Publicity Department, **The British Thomson-Houston Co., Ltd.**, Mazda House, 77, Upper Thames Street, E.C., each shade being packed in a cardboard box suitable for sending through the post.

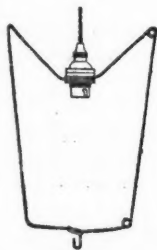


FIG. 1.
Wire frame. 1st
position.

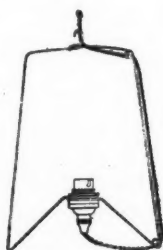


FIG. 2.
Wire frame reversed, ready
to receive lamp and shade.



FIG. 3.
Mazda revolving shade
complete.

REVIEW OF BOOK.

Journal of the British Science Guild (Nov. 1916).

The *Journal of the British Science Guild* for November last contains a number of interesting items including a Memorandum on the Relations which should exist in future between Science and the State, a Memorandum on the Encouragement of Teaching and Research in Science in British Universities, and a Report on Reforms necessary in National Education.

Attention is drawn to the great variation in the average salaries of Professor in the Faculty of Science at the chief Universities of the country. Manchester and Liverpool come first with £888 per annum and £853 per annum respectively; while Southampton and Aberystwyth come last with only £325 and £320 per annum. The remuneration of the Professors and facilities for instruction in science at the Universities and Colleges of South Wales are considered quite

inadequate, and these institutions are urgently in need of further State assistance.

Other suggestions are:—(1). Temporary and Associate Professorships in state-aided Universities should cease and the title of "Regius Professor" involving the status and privileges of Civil Servants, under the Crown, should be conferred on Professors at such institutions. (2) The provision of an adequate scale of pensions for Professors. The Report on National Education is concluded by a long list of concrete suggestions, from which we take the following:—Employers to give reasonable facilities for young persons within the ages of 14 and 17 to attend suitably equipped Continuation Schools for at least six hours per week; "Leaving Certificates" at Primary and Secondary Schools to be instituted; Fuller co-ordination between technical institutions and the Universities to be established; Improved training of teachers and the placing of salaries, superannuation schemes and conditions of tenure on a more satisfactory basis.

LECTURES ON ILLUMINATING ENGINEERING.

We understand that reprints of the lectures on Illuminating Engineering recently delivered at the University of Pennsylvania, U.S.A., will be available early in the present year.

It is anticipated that the selling price of the bound volume will be in the neighbourhood of five dollars.

Applications for particulars should be addressed to Mr. Clarence L. Law, Irving Place and 15th Street, New York.

UNIVERSITY OF ILLINOIS.

New Ceramic Engineering Building.

We notice that a new building devoted to Ceramic Engineering has just been opened at the University of Illinois (U.S.A.).

The building occupies a ground area of 67 by 185 feet and costs approximately a quarter of a million dollars. It is intended for instruction and research on such materials as high grade brick, tiles, terra-cotta, cements, glassware and sanitary ware, &c., which form a very considerable American industry.

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THE EFFECT OF INDUSTRIAL CONDITIONS ON EYESIGHT.

Bulletin No. 15, issued by the Committee on the Health of Munition Workers, draws attention to the prevalence of eye-trouble among munition workers, leading not only to personal suffering and inconvenience, but to serious loss of time and diminished output. Thus in the Coventry and Birmingham district alone it is estimated that 500—700 days' work are lost annually through such defects.

Among the causes of accidents are :—

- (1) Injuries due to exposure to intense heat or industrial poisons.
- (2) Accidents due to flying particles, &c.
- (3) Eye-strain due to uncorrected errors of refraction or other causes.

Attention is drawn to the importance of ascertaining that operators engaged on fine work have sufficient acuteness of vision. Instances have come before the Committee of headaches and eye-strain resulting from (a) inadequate light, both natural and artificial; (b) artificial light adequate in amount but so placed as to throw a glare on the eyes of the worker; and (c) employment of workers (whose eyesight is aided by suitable glasses) to carry out fine work without first testing their eyesight. Eye-strain, including headache, may be one manifestation of general fatigue and is likely to become marked when long hours are worked, night shifts are necessary, or when workers are undernourished, anæmic, or of poor general physique.

In connection with the effects of poor illumination it is remarked :—

"The lighting of factories has so recently been dealt with in detail in the

Report of the Committee on Lighting in Factories and Workshops that no further reference is here needed. But the question of supervision of the eyesight of workers employed on fine detail work calls for special comment." From one factory it is reported that "in contrasting the eye conditions found in the different workshops the worst effects were found in the fuse department where the fine process involved close attention. Here 8 per cent. of the workers had been obliged to obtain glasses since starting the work, 12 per cent. found sight difficult at night, another 7 per cent. complained of eye-strain, and 2 per cent. found eye-strain increasing in severity."

The Committee emphasise the importance of proper examination of eyesight, the prompt reporting of small injuries which, if not treated, may develop more seriously, and, where flying particles of steel or other metals are common, the use of appropriate eye-guards or goggles. A sketch of a suitable type of goggles is provided.

"Revue Generale de l'Electricite."

It is announced that from January 1st onwards *La Lumière électrique* and *La Revue électrique* will be combined in one journal, *La Revue Générale de l'Électricité*, published at 12, Place de Laborde, Paris.

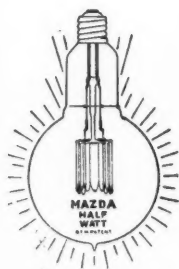
The first number of the new journal contains an editorial summary of the programme of the new journal from the pen of Professor A. Blondel. British readers will wish the new journal every success.

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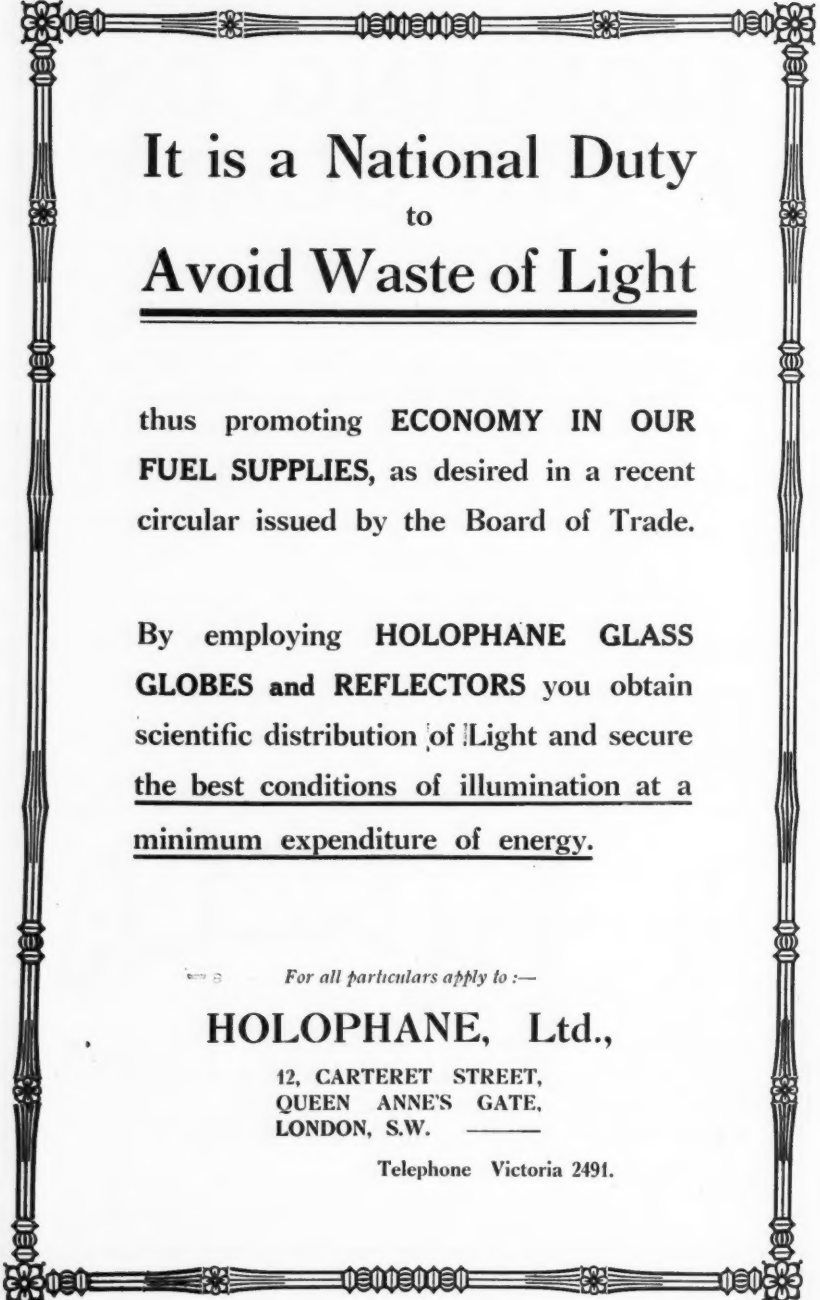
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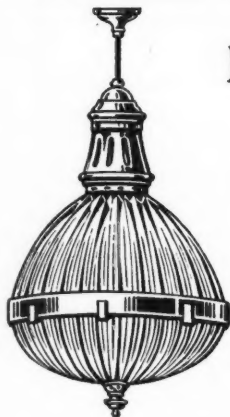
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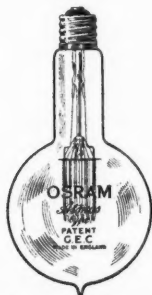
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